Claims

[c1] 1. In a testing procedure for light gauge testing of a part (A) in which a series of light stripes (L1-Ln) are projected onto the part by a structured light system, light reflected from the part being captured by an imaging system for evaluation, a method for setting up and aligning the respective components of used in the testing procedure to obtain optimal information for evaluating acceptability of the part comprising:

initially aligning a light projector and at least one camera of the imaging system with a test specimen of the object;

projecting a series of light stripes (L1-Ln) onto the test specimen and capturing images of light reflections from the specimen;

evaluating the images to determine characteristics of each light stripe;

accepting the test setup and alignment if the characteristics of the light stripes are substantially uniform over a section (S) of the test specimen;

but, modifying the test setup and alignment if any of the characteristics are not substantially uniform over the section.

[c2] 2. The method of claim 1 further including testing parts (A) using the structured light system and imaging system after an acceptable test setup and alignment is achieved.

[c3] 3. The method of claim 2 in which modifying the test setup and alignment includes repositioning the structured light system relative to the test specimen (S).

[c4] 4. The method of claim 3 in which the test specimen (S) is mounted on a fixture, and modifying the test setup and alignment further includes reorienting the test specimen relative to the structured light system by adjusting or moving the fixture.

[c5] 5. The method of claim 1 in which evaluating the images to determine characteristics of each light stripe (L1-Ln) includes determining the number of pixels extending across the width of a light stripe.

[c6] 6. The method of claim 5 in which the number of pixels defining the width of a

light stripe is between (X) pixels and (Y) pixels and is substantially constant along the length of the section (S) of the test specimen.

[c7] 7. The method of claim 5 in which evaluating the images to determine characteristics of each light stripe (L1-Ln) further includes determining the center of each light stripe and the deviation in centeredness along the length of the section (S).

[c8] 8. The method of claim 7 in which the center of each light stripe (L1-Ln) preferably has a standard deviation of <0.07 pixels along the length of the section (S).

[c9] 9. The method of claim 5 in which evaluating the images to determine characteristics of each light stripe (L1-Ln) further includes determining the intensity distribution across the width of a light stripe.

[c10] 10. The method of claim 9 in which the intensity distribution is a Gaussian distribution.

[c11] 11. The method of claim 1 further including focusing each camera (16) used to capture images of the part (A) and light reflected off the part.

[c12] 12. The method of claim 11 in which focusing each camera includes determining if the camera is capable of distinguishing between Grey scale levels within a range of such levels.

[c13] 13. The method of claim 12 wherein focusing the camera includes setting a calibrated illumination source (C) a fixed distance (d) away from the camera and having the camera views the source.

[c14] 14. The method of claim 13 in which the illumination source (C) is an LED source.

[c15] 15. The method of claim 12 further including converting the image captured by the camera to a digital value, and adjusting the gain of the camera to provide a linear change in output for a given Grey scale value.

[c16] 16. The method of claim 15 in which, after the camera gain is adjusted, the

cameras are checked for Grey scale values about the midpoint of the range of Grey scale values observable by the camera.

[c17] 17. The method of claim 1 in which optical components (16w, 16p) of the imaging system are tested to determine if there is any distortion.

[c18] 18. The method of claim 17 in which the measured distortion should be <1 wavelength of distortion per inch.

[c19] 19. The method of claim 17 in which the optical elements are tested by directing a collimated beam through a window/polarizer and using a shearing plate to measure any distortion.

[c20] 20. The method of claim 1 in which the temperature and humidity of the test facility is controlled to provide an optimal testing environment in which performance of the various testing components is not effected by extremes of either.

[c21] 21. In a testing procedure for light gauge testing of a part (A) in which a series of light stripes (L1-Ln) are projected onto the part by a structured light system, light reflected from the part being captured by an imaging system for evaluation, a method for setting up and aligning the respective components of used in the testing procedure to obtain optimal information for evaluating acceptability of the part comprising:

initially aligning a light projector (14) and at least one camera of the imaging system with a test specimen of the object;

projecting a series of light stripes (L1-Ln) onto the test specimen and capturing images of light reflections from the specimen;

evaluating the images to determine characteristics of each light stripe including determining the number of pixels extending across the width of a light stripe, the center of each light stripe and the deviation in centeredness along the length of the section (S), and the intensity distribution across the width of a light stripe;

focusing each camera used to capture images of the part (A) and light reflected off the part, including determining if the camera can distinguish between each

Grey scale level within a range of such levels;

testing optical components of the imaging system to determine if there is any distortion present; and,

accepting the test setup and alignment if the characteristics of the light stripes are substantially uniform over a section (S) of the test specimen, each camera in the imaging system is focused, and any measured distortion is substantially eliminated.

[c22] 22. The method of claim 21 in which the number of pixels defining the width of a light stripe is between (X) pixels and (Y) pixels and is substantially constant along the length of the section (S) of the test specimen, the center of each light stripe (L1-Ln) has a standard deviation of <0.07 pixels along the length of the section (S), and which the intensity distribution is a Gaussian distribution.

[c23] 23. The method of claim 22 in which focusing each camera (16) includes determining if the camera is capable of distinguishing between Grey scale levels within a range of such levels.

[c24] 24. The method of claim 23 wherein focusing the camera includes setting a calibrated illumination source (C) a fixed distance (d) away from the camera and having the camera views the source.

[c25] 25. The method of claim 24 further including converting the image captured by the camera to a digital value, and adjusting the gain of the camera to provide a linear change in output for a given Grey scale value.

[c26] 26. The method of claim 23 in which the measured distortion of the optical elements of the imaging system should be <1 wavelength of distortion per inch, the optical elements are tested by directing a collimated beam through a window/polarizer and using a shearing plate to measure any distortion.

[c27] 27. The method of claim 21 in which the temperature and humidity of the test facility is controlled to provide an optimal testing environment in which performance of the various testing components is not effected by extremes of either.

[c28] 28. In a testing procedure for light gauge testing of a part (A) in which a series of light stripes (L1-Ln) are projected onto the part by a structured light system (14), light reflected from the part being captured by an imaging system for evaluation, a method for setting up and aligning the respective components of used in the testing procedure to obtain optimal information for evaluating acceptability of the part comprising:

initially aligning a light projector and at least one camera of the imaging system with a test specimen of the object;

projecting a series of light stripes (L1-Ln) onto the test specimen and capturing images of light reflections from the specimen;

evaluating the images to determine characteristics of each light stripe including determining the number of pixels extending across the width of a light stripe, the center of each light stripe and the deviation in centeredness along the length of the section (S), and the intensity distribution across the width of a light stripe;

accepting the test setup and alignment if the characteristics of the light stripes are substantially uniform over a section (S) of the test specimen;

but, modifying the test setup and alignment if any of the characteristics are not substantially uniform over the section.

[c29] 29. The method of claim 26 further including focusing each camera used to capture images of the part (A) and light reflected off the part, including determining if the camera can distinguish between each Grey scale level within a range of such levels, and testing optical components of the imaging system to determine if there is any distortion present.